## Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

## Listing of Claims:

1. (Currently Amended) A microfluidic device ~~adapted for conducting assays comprising a solid substrate layer having a surface that is capable of attaching ligand and/or anti-ligand, and an elastomeric layer attached to said solid substrate surface, wherein said elastomeric layer comprises~~ comprising:

~~(a)~~ a plurality of first flow channels~~[[;]]~~ and

~~(b)~~ a plurality of second flow channels, each such second flow channel intersecting ~~and crossing each of said~~ multiple of the first flow channels ~~thereby providing a plurality of~~ to define intersecting ~~areas formed at intersections between said first flow channels and said second flow channels, wherein said plurality of first flow channels and said plurality of second flow channels are adapted to allow the flow of a solution therethrough, and wherein said solid substrate surface is in fluid communication with at least said intersecting areas of said plurality of first flow channels and said plurality of second flow channels, and wherein said plurality of first flow channels and/or said plurality of second flow channels are capable of forming~~ volumes and a plurality of looped flow channels that each include segments of the flow channels between the intersecting volumes to define a closed loop;

~~(c) a plurality of control channels;~~

~~(d)~~ a plurality of ~~first~~ control valves, each such control valve having a control channel and a deformable segment disposed to restrict flow through a respective one of the first and second flow channels in response to an actuation force applied to the control channel to deflect the deformable segment ~~operatively disposed with respect to each of said first flow channel to regulate flow of the solution through said first flow channels, wherein each of said first control valves comprises a first control channel and an elastomeric segment that is deflectable into or retractable from said first flow channel upon which said first control~~

~~valve operates in response to an actuation force applied to said first control channel, the elastomeric segment when positioned in said first flow channel restricting solution flow therethrough;~~

~~(e) a plurality of second control valves each operatively disposed with respect to each of said second flow channel to regulate flow of the solution through said second flow channels, wherein each of said second control valves comprises a second control channel and an elastomeric segment that is deflectable into or retractable from said second flow channel upon which said second control valve operates in response to an actuation force applied to said second control channel, the elastomeric segment when positioned in said second flow channel restricting solution flow therethrough;~~

~~(f) a plurality of loop forming control valves each operatively disposed with respect to each of said first and/or said second flow channels to form said plurality of looped flow channels, wherein each of said loop forming control valves comprises a loop forming control channel and an elastomeric segment that is deflectable into or retractable from said first and/or said second flow channels upon which said loop forming control valve operates in response to an actuation force applied to said loop forming control channel, the elastomeric segment when positioned in said first and/or said second flow channels restricting solution flow therethrough thereby forming said looped flow channel~~; and

~~(g)~~ a ~~plurality of recirculating~~ pumps~~, and wherein each recirculating pump is~~ operatively disposed ~~with respect~~ to regulate flow through one of said looped flow channels ~~such that circulation of solution through each of said looped flow channels can be~~ to regulate~~d~~ flow by ~~one of said~~ the recirculating pump~~s~~.

2. (Currently Amended) The microfluidic device of Claim 1, wherein ~~each of said plurality of~~ the recirculating pumps comprises ~~more than one~~ multiple control channels ~~each~~ formed within ~~said~~ an elastomeric layer and separated from ~~said~~ the looped flow channel by an elastomeric segment ~~which is~~ deflectable into ~~said~~ the looped flow channel in response to an actuation force.

3. (Currently Amended) The microfluidic device of Claim 1, wherein actuation of ~~both of said plurality of first control valves and said plurality of second~~ the control valves forms a plurality of holding valves, each ~~of which is~~ such holding valve being operatively disposed ~~with respect to each of said first and said second flow channels such that~~ to form a holding space encapsulating ~~each of said~~ one of the intersecting ~~area is formed~~ volumes.

4. (Original) The microfluidic device of Claim 1 further comprising a solution inlet for each of said first flow channels in fluid communication therewith for introduction of a first solution.

5. (Original) The microfluidic device of Claim 4 further comprising a second solution inlet for each of said second flow channels in fluid communication therewith for introduction of a second solution.

6. (Currently Amended) The microfluidic device of Claim 1, wherein ~~said plurality of first flow channels and said plurality of second~~ the flow channels are located on ~~the~~ an interface between ~~said~~ a solid substrate layer and ~~said~~ an elastomeric layer such that one side of each ~~of said first and said second~~ flow channels is formed by said solid substrate surface.

7. (Currently Amended) The microfluidic device of Claim 1, wherein: ~~said plurality of first flow channels and said plurality of second~~ the flow channels are located within ~~said~~ an elastomeric layer[[,]]; and

~~wherein~~ each of ~~said plurality of~~ the intersecting ~~areas formed at intersections between said first flow channels and said second flow channels~~ volumes comprises a via ~~which is~~ in fluid communication with ~~said~~ a solid substrate surface to ~~thereby~~ form~~ing~~ a well ~~that is adapted to~~ for collecting ~~a~~ fluid ~~therein~~.

8. (Currently Amended) The microfluidic device of Claim 1 further comprising a plurality of first flow channel pumps, ~~wherein~~ each ~~of said~~ such first flow channel pump ~~is~~ being operatively disposed ~~with respect to one of said first flow channels such that~~ to regulate solution flow through a respective one of the ~~each of said~~ first flow channels ~~can be regulated by one of the pumps~~.

9. (Currently Amended) The microfluidic device of Claim 8 further comprising a plurality of second flow channel pumps, ~~wherein~~ each ~~of said~~ such second flow channel pump ~~is~~ being operatively disposed ~~with respect to one of said second flow channels such that~~ to regulate solution flow through a respective one of the ~~each of said~~ second flow channels ~~can be regulated by one of the pumps~~.

10. (Currently Amended) The microfluidic device of Claim 9, wherein each ~~of said plurality of~~ such flow channel pumps comprises ~~more than one~~ multiple control channels ~~each~~ formed within ~~said~~ an elastomeric layer and separated from ~~said~~ the respective flow channel by an elastomeric segment ~~which is~~ deflectable into ~~said~~ the respective flow channel in response to an actuation force.

11. (Currently Amended) The microfluidic device of Claim 1 further comprising a first solution outlet channel in fluid communication with each of said first flow channels ~~such that the~~ to receive solution flowing from each of said first flow channels ~~flows out into said first solution outlet channel~~.

12. (Currently Amended) The microfluidic device of Claim 1 further comprising a second solution outlet channel in fluid communication with each of said second flow channels ~~such that the~~ to receive solution from each of said second flow channels ~~flow out into said second solution outlet channel~~.

13. (Currently Amended) The microfluidic device of Claim 1, ~~wherein said~~ further comprising a solid support surface ~~at each of said intersecting areas comprises~~ having a ligand that is capable of ~~specifically~~ binding to a specific antiligand ~~that are present in the solution~~ at each of the intersecting volumes.

14. (Currently Amended) A method of conducting a binding assay with a microfluidic device having a plurality of first flow channels and a plurality of second flow channels, each such second flow channel intersecting multiple of the first flow channels to define intersecting volumes and a plurality of looped flow channels that each include segments of the flow channels between the intersecting volumes to define a closed loop, a plurality of control valves, each such control valve having a control channel and a deformable segment disposed to restrict flow through a respective one of the first and second flow channels in response to an actuation force applied to the control channel to deflect the deformable segment, and a recirculating pump operatively disposed to regulate flow through one of the looped flow channels to regulate flow by the recirculating pump, the method comprising:

~~(a) providing a microfluidic device comprising a solid substrate layer having a surface that is capable of attaching ligand and/or anti-ligand, and an elastomeric layer attached to said solid substrate surface, wherein said elastomeric layer comprises:~~

~~(i) a plurality of first flow channels;~~

~~(ii) a plurality of second flow channels each intersecting and crossing each of the first flow channels thereby providing a plurality of intersecting areas formed at intersections between the first flow channels and the second flow channels, wherein the plurality of first flow channels and the plurality of second flow channels are adapted to allow the flow of a solution therethrough, and wherein the solid substrate surface is in fluid communication with at least the intersecting areas of the plurality of first flow channels and the plurality of second flow channels, and wherein the plurality of first flow channels and/or the plurality of second flow channels are capable of forming a plurality of looped flow channels;~~

~~(iii) a plurality of control channels;~~

~~(iv) a plurality of first control valves each operatively disposed with respect to each of the first flow channel to regulate flow of the solution through the first flow channels, wherein each of the first control valves comprises a first control channel and an elastomeric segment that is deflectable into or retractable from the first flow channel upon which the first control valve operates in response to an actuation force applied to the first control channel, the elastomeric segment when positioned in the first flow channel restricting solution flow therethrough;~~

~~(v) a plurality of second control valves each operatively disposed with respect to each of the second flow channel to regulate flow of the solution through the second flow channels, wherein each of the second control valves comprises a second control channel and an elastomeric segment that is deflectable into or retractable from the second flow channel upon which the second control valve operates in response to an actuation force applied to the second control channel, the elastomeric segment when positioned in the second flow channel restricting solution flow therethrough;~~

~~(vi) a plurality of loop forming control valves each operatively disposed with respect to each of the first and/or the second flow channels to form the plurality of looped flow channels, wherein each of the loop forming control valves comprises a loop forming control channel and an elastomeric segment that is deflectable into or retractable from the first and/or the second flow channels upon which the loop forming control valve operates in response to an actuation force applied to the loop forming control channel, the elastomeric segment when positioned in the first and/or the second flow channels restricting solution flow therethrough thereby forming the looped flow channel; and~~

~~(vii) a plurality of recirculating pumps, and wherein each recirculating pump is operatively disposed with respect to one of the looped flow channels such that circulation of solution through each of the looped flow channels can be regulated by one of the recirculating pumps;~~

~~(b)~~ applying an actuating force to ~~the second~~ each control channel of a first plurality of the control valves to restrict solution flow through each of the second flow channels;

~~(c)~~ introducing a reagent comprising a ligand into at least one of the first flow channels under conditions sufficient to attach the ligand covalently to ~~the~~ a solid substrate surface;

~~(d)~~ removing the actuation force to the ~~second~~ each control channel of the plurality of ~~flow channel~~ control ~~channel~~ valves and applying an actuation force to each control channel of a second plurality of the ~~first~~ control ~~channel~~ valves such that solution flow through the ~~first flow~~ each control channel of the second plurality of control valves is restricted; and

~~(e)~~ performing a binding assay by introducing a sample solution into the second flow channels under conditions sufficient to specifically bind an antiligand that may be present in the sample solution to the ligand that is covalently attached to the solid substrate surface.

15. (Currently Amended) The method of Claim 14 further comprising removing any ligand that is not attached to the solid substrate surface from the each control channel of the second plurality of control valves prior to introducing the sample solution into the second flow channels.

16. (Currently Amended) The method of Claim 14, wherein:

~~said step (e) of~~ performing the binding assay comprises applying an actuating force to the ~~plurality of loop forming~~ control valves to form ~~the~~ a plurality of looped ~~sample~~ flow channels; and

circulating the sample solution within each of the looped ~~sample~~ flow channels ~~using~~ the recirculating pumps.

17. (Currently Amended) The method of Claim 14, wherein ~~said step (e) of~~ performing the binding assay comprises applying an actuating force to ~~both of the plurality of first control valves and the plurality of second~~ the control valves after introducing the sample solution into the second flow channels such that a plurality of holding spaces ~~is~~ are formed ~~wherein each holding spaces~~ to encapsulates ~~one~~ each of the intersecting ~~areas~~ volumes,

thereby allowing a prolonged contact between the sample solution and the ligand that is attached to the solid substrate surface ~~on~~ the intersecting ~~areas~~ volumes.

18. (Currently Amended) The method of Claim 14, wherein:

the ~~plurality of first flow channels and the plurality of second~~ flow channels are located within ~~the~~ an elastomeric layer[[,]]; and

~~wherein~~ each of the intersecting ~~areas formed at intersections between the first flow channels and the second flow channels~~ volumes comprises a via ~~which is~~ in fluid communication with the solid substrate surface to ~~thereby~~ form~~ing~~ a well ~~that is adapted to~~ for collecting ~~a~~ fluid ~~therein~~.

19. (Currently Amended) The method of Claim 14, wherein: the first flow channels ~~is~~ are in communication with a pump~~[[,]]~~; and

~~wherein~~ the reagent is transported through the first flow channels under ~~the~~ action of the pump.

20. (Currently Amended) The method of Claim 19, wherein the pump comprises ~~more than one~~ multiple control channels ~~each~~ formed within ~~the~~ an elastomeric layer and separated from the first flow channels by ~~an~~ elastomeric segments ~~that is~~ deflectable into the first flow channels in response to an actuation force, whereby the reagent is transported along the first flow channels.

21. (Currently Amended) The method of Claim 14, wherein the second flow channels ~~is~~ are in communication with a pump~~[[,]]~~; and

~~wherein~~ the sample solution is transported through the second flow channels under ~~the~~ action of the pump.

22. (Currently Amended) The method of Claim 21, wherein the pump comprises ~~more than one~~ multiple control channels ~~each~~ formed within ~~the~~ an elastomeric layer

and separated from the second flow channels by ~~an~~ elastomeric segments ~~that is~~ deflectable into the second flow channels in response to an actuation force, whereby the sample solution is transported along the second flow channels.

23. (Currently Amended) The method of Claim 14, wherein ~~said step (e) of~~ performing the binding assay comprises removing ~~the~~ an elastomeric layer from the solid substrate surface and determining ligand/antiligand binding at each of the intersecting ~~areas~~ volumes with a detector.

24. (Currently Amended) The method of Claim 23, wherein the detector detects an optical signal within the intersecting ~~areas~~ volumes.

25. (Original) The method of Claim 24, wherein the detector detects a fluorescence emission, fluorescence polarization or fluorescence resonance energy transfer.

26. (Original) The method of Claim 24, wherein the detector is an optical microscope, a confocal microscope or a laser scanning confocal microscope.

27. (Currently Amended) The method of Claim 23, wherein the detector is a non-optical sensor selected from the group consisting of a radioactivity sensor[[,]] and an electrical potential difference sensor.

28. (Currently Amended) The method of Claim 14, wherein performing the binding assay comprises detecting binding between a substrate and a cell receptor; a substrate and an enzyme; an antibody and an antigen; a nucleic acid and a nucleic acid binding protein; a protein and a protein; a small molecule and a protein; a small molecule and an oligonucleotide; and a protein affinity tag and a metal ion.

29. (Original) The method of Claim 14, wherein the assay is an assay for detecting a toxic effect on cells or a cell death assay, or a cell proliferation assay.

30. (Original) The method of Claim 14, wherein the assay is an oligonucleotide binding assay or a peptide binding assay.

31. (Original) The method of Claim 14, wherein the assay is an antimicrobial assay.

32. (Currently Amended) A method for producing a microfluidic device comprising:

~~(a)~~ producing a control layer, a flow layer, and a via layer from an elastomeric polymer, wherein each of the control layer and the flow layer comprises grooves on ~~its~~ respective surfaces for forming control channels and flow channels~~, respectively~~; and

~~(b)~~ attaching the control layer to the flow layer such that the grooves in the control layer ~~is~~ are attached to a top surface of the flow layer ~~thereby~~ to form~~ing~~ a plurality of control channels and attaching ~~the~~ a bottom surface of the flow layer to the via layer ~~thereby~~ to form~~ing~~ a plurality of first flow channels and a plurality of second flow channels, wherein each first flow channels intersects ~~and crosses each~~ multiple of the second flow channels ~~thereby~~ to form~~ing~~ a plurality of channel intersections, and wherein a via~~s~~ in the via layer is positioned at each channel intersection~~s; and~~

~~(c) optionally attaching the elastomeric polymer produced in said step (b) to a solid substrate which is comprises a ligand bound to its surface or comprises a functional group which is capable of attaching a ligand~~.

33. (Currently Amended) The method of Claim 32, wherein ~~said step of~~ producing the via layer ~~further~~ comprises etching the via layer to produce a plurality of vias.

34. (Original) The method of Claim 32, further comprising attaching the elastomeric polymer to a solid substrate that comprises a ligand bound to its surface or comprises a functional group capable of attaching a ligand.